ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-416/95-16

License: NPF-29

Licensee: Entergy Operations, Inc.
P.O. Box 756
Port Gibson, MS 39150

Facility Name: Grand Gulf Nuclear Station

Inspection At: Port Gibson, Mississippi

Inspection Conducted: September 10 through October 21, 1995

Inspectors: J. Tedrow, Senior Resident Inspector
C. Hughey, Resident Inspector
G. Pick, Project Engineer

Approved: P. H. Harrell, Acting Chief, Project Branch D — Date: 11/9/95

Inspection Summary

Areas Inspected: Routine, unannounced inspection of onsite review of events, operational safety verification, maintenance and surveillance observations, onsite engineering, plant support activities, and followup operations.

Results:

Plant Operations

- Operations personnel performed well in response to a reactor scram, which occurred due to the loss of a reactor feedwater pump (RFP) (Section 2.1).

- The restoration of the condensate transfer system after a tagout resulted in a high number of personnel errors, which was an indication that additional management attention was required (Section 3.1).

- The decision of the shift superintendent to suspend all plant activities while attempting to determine the reason for the increase in offgas flow was excellent (Section 3.1).

Maintenance

- As a result of poor planning for the fumigation of the plant service water (PSW) pump houses, reactor power was reduced because a portion of the system became inoperable (Section 2.2).

- The job preplanning for installation of a flow orifice in the cooling water line for the reactor core isolation cooling (RCIC) pump was deficient in that it did not identify that the modification activity would require cutting a pipe containing a large amount of potentially radioactive water (Section 4.3).

Engineering

- The establishment of a replacement frequency for the RCIC rupture disc was considered to be proactive (Section 4.1).

- The efforts of the engineering staff to monitor the vibrations of the reactor recirculation pumps was considered very good (Section 6.1).

Plant Support

- The security program was effectively implemented (Section 7.1).

- The health physics program was effectively implemented, including the control of high radiation doors (Section 7.2).

Summary of Inspection Findings:

New Items

None

Closed Items

Violation 416/9511-01 (Section 8)

DETAILS

1 PLANT STATUS

The plant began this inspection period at 100 percent power. A reactor scram occurred on September 17, 1995, during a routine test of RFP B. After repairs were completed, the unit reached 100 percent power on September 23.

Power was reduced to about 60 percent on September 25 and returned to 100 percent the same day after a partial loss of PSW. Power remained at 100 percent power for the remainder of this inspection period, except for minor power reductions for routine control rod and turbine surveillance activities.

2 ONSITE REVIEW OF EVENTS (93702)

2.1 Reactor Scram Due to Trip of RFP B

On September 17, 1995, a control room reactor operator was performing a monthly test of RFP B governor, in accordance with Equipment Performance Instruction 04-1-03-N21-5. During the test, the operator depressed and held the pushbutton for the RFP B test lockout, which prevents RFP B from tripping during the test. The operator then observed the white status light above the pushbutton extinguish and the amber light next to it illuminated, which indicated that the trip was locked out. The next step would have been to depress the pushbutton for the overspeed test; however, the amber light turned off and RFP B tripped.

After RFP B tripped, the recirculation flow control valves partially shut, as required, and power decreased. RFP A speed and flow automatically increased to maintain vessel level but level did not increase. The operator stated, during the posttrip review, that RFP A appeared to be operating normally.

Vessel level decreased very quickly and a reactor scram occurred at Level 3 (+11.4 inches). Vessel level continued to decrease until the high pressure core spray (HPCS) system initiated at Level 2 (-41.6 inches). The reactor recirculation pumps and the main turbine tripped, as expected. However, no RCIC system start or auxiliary building isolation occurred, as should have at the Level 2 setpoint. Preliminary investigations indicated that the lowest vessel level that occurred bordered at Level 2; therefore, the failure of the RCIC system to start and the isolation signal to initiate was due to normal instrument error band. Vessel level recovered quickly after the HPCS system was initiated.

The inspector responded to the control room and observed scram recovery operations. The inspector observed very good response by the control room operators after the scram. Command, control, and communications were good during the event.

The licensee initiated investigations to determine: (1) why RFP B tripped after the pushbutton was depressed, (2) why RFP A did not maintain vessel level after RFP B tripped, and (3) why RCIC did not start and the auxiliary building isolate at Level 2 in the vessel.

The cause of the RFP B trip was determined to be a failed pressure regulating valve (1N21N207B) in the lube oil system. This valve controls lube oil pressure to the thrust bearing. After the regulating valve was removed and inspected, a nut, which maintains a seal between the diaphragm and the stem, was found loose. This permitted the stem to move downward, thus allowing oil to leak into the area above the diaphragm and affecting the ability of the valve to regulate downstream oil pressure. When the pushbutton was depressed by the operator just prior to the scram, the system experienced a typical pressure fluctuation; however, the degraded pressure regulating valve could not handle the system pressure fluctuation and the pressure downstream of the valve exceeded the thrust bearing trip signal causing a pump trip. The licensee indicated that there was no history of failure with this type of valve, which had been in service for about 10 years. The regulating valve was subsequently replaced.

The cause of the inability to maintain vessel level with RFP A, after RFP B tripped, was determined to be the failure of the RFP B discharge check valve (N21-F015B) to close. This allowed reverse flow from RFP A back through RFP B and thereby diverting a majority of the feedwater flow from the reactor vessel. Some flow to the vessel was maintained, but not enough to maintain level. During an internal inspection of Valve N21-F015B after the scram, the licensee noted that the stop arm for the disc was worn and did not make solid contact with the seat ring, which allowed the disc to open too far. By opening too far, the valve was prevented from closing during reverse flow conditions.

To prevent recurrence, about 3/8 inch of weld buildup was added to the disc stop arm to limit disc movement. In addition, a spring plunger assembly was reinstalled in the valve to assist in initial closure. This assembly had not been installed in the valve because, per the manufacturer, it was not required in a horizontally installed valve such as this one. The licensee had previously chosen to leave it out because of loose parts concerns. The same repairs were also completed to the RFP A pump discharge check valve.

An investigation by the licensee concluded that the apparent failure of RCIC to start and the auxiliary building isolation not to occur was due to the rapid recovery of vessel level upon reaching Level 2, due to the HPCS initiation and some feedwater flow to the vessel from RFP A. The inspectors independently reviewed: (1) the on-shift scram analysis, (2) the most recent calibration data packages for wide-range reactor water Level 1 and 2 inputs to various system logics, (3) the sequence-of-events printout during and after the scram, (4) the reactor vessel level strip chart recordings, and (5) the graphs of vessel level from the plant data system. Based on the review of this data, the inspectors concluded that all safety systems functioned as designed during and after the scram.

2.2 Reduction in PSW Cooling Due to Poor Planning

On September 25, 1995, reactor power was reduced due to a reduction of PSW flow. Licensee personnel had secured the PSW pump house ventilation fans to allow for fumigation. The pumps remained in operation after the fans were secured and subsequently the room temperature increased due to motor heat. Fire protection temperature switches, associated with the ventilation fans, tripped due to the elevated temperatures and prevented restart of the fans. As room temperatures continued to increase, PSW pumps tripped due to thermal overload caused by the excessive ambient temperatures in the pump house, which left just two pumps in service to supply PSW flow. In accordance with Procedure 05-1-02-V-11, "Loss of Plant Service Water," plant power was reduced to approximately 60 percent to reduce heat loads on the PSW system.

The inspectors reviewed this event and concluded that the planning for this work was poor in that no obvious consideration had been given with respect to the effect on the PSW pumps or system when the pump house ventilation fans were secured. The licensee implemented actions to ensure proper planning was performed prior to completion of the evolution in the future.

2.3 Failure of Offsite Feeder Breaker to Division I Safety Bus

During the monthly functional test of the Division I emergency diesel generator (EDG) on October 3, 1995, offsite feeder Breaker 152-1514, from safety-related Transformer 11 to Division I Bus 15AA, tripped open. This occurred when output Breaker 152-1508 from the Division I EDG was being closed while attempting to parallel the diesel to the grid. Although the EDG continued to supply power to the bus, none of the three offsite feeders could be paralleled to the bus. Troubleshooting by the licensee identified a failed 125-Vdc Agastat relay associated with the EDG output breaker, which functioned to allow parallelling the EDG with offsite sources. The relay was replaced and the offsite feeder breaker was closed.

The EDG carried the Division I bus for approximately 4 hours, while the relay was replaced, with no difficulties. Further investigations revealed a separated coil wire internal to the relay. At the end of this inspection period, the licensee had initiated, but not completed, an investigation into the cause of the relay failure and any similarities to previous failures of 125-Vdc relays. The inspectors will review the licensee's activities in this area during future inspections.

3 OPERATIONAL SAFETY VERIFICATION (71707)

3.1 Poor System Restoration from a Tagout of the Condensate Transfer System

During the observation of the performance of a temporary special test instruction associated with the feedwater control system, the inspectors noted that the flow through the offgas system suddenly increased from about 40 to 100 scfm and condenser vacuum decreased about 1/2 inch Hg. The shift

superintendent suspended the special test so control room efforts could be focused on the cause of the increased flow.

During the investigation, a radwaste supervisor discovered an improper tagout associated with the condensate phase separator that possibly allowed air to enter the main turbine seal steam generator system via the condensate transfer system. This tagout was being cleared at the same time the offgas excursion occurred. This later turned out not to be the cause of the increased offgas flow. It was later determined to be a problem with a valve in the turbine building sample panel, which was repaired.

Although apparently unrelated to the increase in offgas problem, several examples of poor work were identified during the licensee's investigation of the radwaste tagout restoration, which included the failure: (1) to perform a valve lineup as required prior to removing the clearance, (2) to follow special instructions in the clearance, (3) of the radwaste operator to perform a walkdown of the area under maintenance prior to restoration, (4) of a control room operator to properly review the clearance prior to issuance, and (5) of the tagout preparer to include more specific instructions regarding tagout restoration. In addition, prior to beginning the feedwater control system special test, the control room shift superintendent requested that all unnecessary activities be stopped in the plant. This message was apparently never received by the radwaste operator performing the tagout restoration and was an indication of poor communications between the control room and radwaste personnel.

Since the multiple restoration deficiencies occurred on a nonsafety-related system, this event had minimal impact on safe plant operation. However, the relatively high number of human errors associated with the clearance of a single tag out was an indication that additional management attention is needed in this performance area. The licensee implemented corrective actions for this problem, which the inspector considered to be satisfactory.

The inspectors noted that the suspension of the test by the control room shift superintendent, so that control room activities could be focused on the offgas problems, was an example of excellent command and control by the operations staff.

3.2 Plant Tours

During a tour of the auxiliary building on October 17, 1995, the inspectors noted that the debris screens for the residual heat removal (RHR) A pump motor were installed but the screens for RHR B pump motor were missing. The inspectors discussed the potential effect of the missing screens on the environmental qualification of RHR B pump and motor with licensee personnel. A deficiency report (MNCR 0268-95) was issued by the licensee to document the nonconformance and initiate the work order process.

After discussing this issue with the motor manufacturer, licensee personnel informed the inspectors that the wire mesh screens were provided to prohibit

small rodents/debris from entering the motor air vents and deteriorating the motor windings. The inspectors verified that no foreign material was present in the motor or in the pump room and did not find any evidence of rodents. The inspectors also established that the environmental qualification of the motor was not in jeopardy since the omission of the screen did not adversely affect the service lifetime of the motor or the capability of the motor to operate properly in an adverse environment.

Until the screens can be installed, licensee personnel will verify, once per shift, that rodents/debris are not present in the pump room. Since no possible damage could occur to the motor that would prevent it from performing its safety function and the environmental qualification of the equipment was not affected, the inspectors considered this observation to be of minor safety significance. The licensee's actions to address the deficiency were considered to be appropriate.

During a tour of the auxiliary building on September 12, the inspectors noted that the cooling coil for the RCIC pump room cooler was dirty. Licensee personnel were informed of this observation and the cooling coil was cleaned. During subsequent tours, the inspector also noted that the HPCS and RHR A and B pump room coolers were dirty, but to a lesser degree.

The inspector discussed these observations with licensee personnel to determine if periodic checks of these coolers were performed. Due to historical problems with proper operation of these types of coolers, the licensee had instituted periodic performance monitoring to verify cooler capacity, so that appropriate maintenance could be scheduled to correct deficiencies.

The inspector reviewed the periodic task sheets, completion dates, and the procedures implemented to conduct the monitoring of the safety-related equipment rooms, containment, and drywell coolers. The licensee's actions to monitor proper operation of the coolers was considered to be appropriate.

During a tour of the EDG 13 (Division III EDG) room on September 29, the inspectors noted that the door for Control Panel 1H22-P118 was ajar. A placard on the door stated that the door should not be left open or unattended per the requirements of Procedure 04-1-01-P81-1, "High Pressure Core Spray Diesel Generator." This discrepancy was reported to control room and an operator shut the door.

The inspectors reviewed the procedural requirements, discussed the issue with licensee personnel, and determined that the panel door was required to be closed to maintain the seismic qualification of the control panel. The procedure allowed 8 hours during which the door could be left open without an additional assessment of the seismic affects on the panel.

The inspectors reviewed the security access log for the room and interviewed the auxiliary operator performing rounds on the morning of September 29. The auxiliary operator stated that the door was not ajar when he made his rounds

that morning. Although the licensee could not identify the exact time the door had been opened, the inspector determined that the door could have been left open for a maximum of a couple of hours. The inspectors concluded that this deficiency had minor safety significance.

4 MAINTENANCE OBSERVATIONS (62703)

During this inspection period, the inspectors observed portions of the maintenance activities listed below. The observations included a review of the following work orders (WO):

- WO 152432 - RCIC Overspeed Test
- WO 151347 - Inspect/Replace Division I EDG Left Bank No. 6 Cylinder Head Gasket
- WO 150543 - Replace the RCIC Turbine Vent Rupture Discs
- WO 072695 - Replace the RCIC Mechanical Overspeed Trip Device
- WO 044655 - Install a Flow Orifice for the RCIC Lube Oil Cooler

Except as noted below, no notable strengths or weaknesses were observed by the inspectors:

4.1 WO 150543 - Replace the RCIC Turbine Vent Rupture Discs

This work was performed as a response to NRC Information Notice 93-67, "Bursting of High Pressure Coolant Injection Steam Line Rupture Discs Injures Plant Personnel." The licensee initiated a preventive maintenance replacement and inspection of the RCIC rupture discs. After a discussion with the rupture disc manufacturer, review of the failure history of these components, and a review of rupture discs application in the RCIC system operating characteristics, a replacement frequency of 42 months was established. This work was the first replacement performed following establishment of the periodic replacement.

The inspector observed portions of this work and inspected the removed rupture discs. No damage was noted. The inspector determined that the work was performed in accordance with the instructions provided in the work package.

4.2 WO 72695 - Replace the RCIC Mechanical Overspeed Trip Device

As discussed in NRC Inspection Report 50-416/95-12, the RCIC pump tripped following activation after a reactor scram on July 12, 1995. As a result of a licensee investigation, worn parts were identified on the RCIC mechanical overspeed trip device.

During this maintenance activity, the overspeed trip device was disassembled and the worn tappet nut replaced. The inspector observed performance of the work and inspected the worn parts. Following reassembly, the linkage between the trip and throttle valve and mechanical overspeed trip device was

physically agitated several times to ensure inadvertent activation would not occur. The inspector noted that the work was accomplished in accordance with the work package instructions.

The inspectors observed portions of the retest (WO 00152432), which consisted of running the pump turbine uncoupled from the pump using relatively high pressure steam from the main steam lines. The test was temporarily suspended by the control room shift superintendent due to problems with relatively large incremental increases in pump turbine speed as it approached the trip point. This was the first time this test (with the pump and turbine uncoupled) had been performed with high pressure steam and it resulted in an unexpectedly large increased in pump speed as steam pressure to the turbine was increased. After procedural changes were issued, the test was successfully completed.

The inspectors considered actions taken by the shift superintendent to suspend test activities until the appropriate test changes were made to be an example of excellent command and control.

4.3 WO 044655 - Install a Flow Orifice for the RCIC Lube Oil Cooler

Licensee personnel initiated a deficiency report (MNCR 0064-93) to identify a potential deficiency with the capacity of RCIC lube oil cooler relief Valve 1E51-F015 in the event that the upstream pressure control valve were to fail. Since the lube oil cooler is cooled with RCIC pump discharge water, the pump discharge pressure, if not relieved, could potentially overpressurize the cooler and associated piping, which was not designed for such high pressure.

During this work, a flow orifice was installed in the lube oil cooler inlet piping upstream of the pressure control valve to limit the maximum flow through this line, and thereby prevent overpressurization of the piping and components. The inspector observed the cutting of the pipe for the orifice installation and reviewed the completed modification package and testing documentation. A system inservice leakage test was performed following completion of work.

The inspector observed that several gallons of potentially contaminated water leaked onto the floor when the pipe was cut. The mechanic performing the work was dressed in protective clothing. The health physics technician covering the job was not expecting the volume of water that leaked from the system, and responded by directing the water to a floor drain and roped off an approximately 25 square foot area as a contaminated area. The area was surveyed and determined to be slightly contaminated.

After the work, the inspector inquired if a deficiency report had been generated and was informed that the situation was not deemed to be abnormal since some water was expected to leak out due to the equipment clearance boundaries. The inspector questioned operations and planning personnel to determine why the system had not been drained prior to work. Licensee personnel initially decided to attempt this work without completely draining the system and to contain any leakage with a drip bag. After this decision,

the job was postponed for several weeks and different personnel were directed to support the work. The expectation of leakage was not adequately communicated to the health physics technician actually covering the job and, subsequently, no measures were taken to collect the potential leakage.

The inspector considered the planning for this work to be poor since the system was not completely drained prior to work and preparations were not adequately taken to collect the potential leakage of contaminated water. Also, the inspector considered documentation of the deficiency to identify corrective action was lacking. Since the workers involved in this incident did not become contaminated, the inspector considered the safety significance of this finding to be minimal.

5 SURVEILLANCE OBSERVATIONS (61726)

The inspectors observed the performance of portions of the surveillance tests listed below:

- Procedure 06-IC-1C51-Q-0001, Rev 100, "APRM Neutron Flux Upscale and Flow Alarm, Channel H"
- Procedure 06-OP-1E51-Q-0003, Rev 100, "RCIC System Quarterly Pump Operability Verification"
- Procedure 06-IC-1C51-R-0004, Rev 100, "APRM RPS Response Time Test"

The inspectors concluded that the licensee safely performed these surveillance tests in accordance with established procedures. No significant strengths or weaknesses were observed by the inspectors.

6 ONSITE ENGINEERING (37551)

6.1 Reactor Recirculation Pump Vibrations

The inspectors continued to review the licensee's activities to monitor changes in Reactor Recirculation Pump A vibrations, which occurred during plant power reductions. On October 8, 1995, during steady-state operations, similar pump vibrations occurred in conjunction with seal temperature and cavity pressure oscillations. Peak vibration rose to approximately 12 mils with an accompanying phase shift. The oscillations ceased after approximately 2 hours and the parameters returned to normal, except pump vibration amplitude which increased from 5 to approximately 8 mils. This peak amplitude was below the pump vibration alarm limit of 20 mils.

Licensee engineering personnel analyzed the data collected during the transient and determined that this event was similar to past transients. The licensee experienced previous problems with recirculation pump shaft cracking and was closely monitoring the vibration data to identify similar failures with these new modified pump shafts. The inspectors observed on-shift

personnel reviewing the actions required for a potential decrease in recirculation system flow rate, as specified by Procedure ONEP 05-1-02-III-3. In addition, licensee personnel were developing contingency plans for pump seal or shaft replacement in case the pump/seal further degraded. The inspector considered the licensee's actions to be appropriate.

6.2 Failed Fuel Action Plan

On September 9, 1995, during a plant power reduction to perform main turbine valve testing, licensee personnel noticed increased offgas pretreatment radiation activity. Chemistry samples and analyses confirmed the presence of a fuel failure. Reactor engineering personnel analyzed the data and determined that a single fuel failure existed in a second burned bundle located in a central core position. The inspectors reviewed the licensee's efforts to identify the location and quantify the fuel failure. The reactor coolant system activity remained well below Technical Specification limits. Licensee personnel stated that offgas activity will be monitored to identify additional degradation, in accordance with Procedure 17-S-02-701, "Failed Fuel Action Plan." The inspector considered the licensee's actions to be appropriate.

7 PLANT SUPPORT ACTIVITIES (71750)

7.1 Security Observations

The inspectors periodically observed security practices to verify that security officers implemented the Security Plan in accordance with site procedures. Search equipment at the access control points was appropriately maintained, vital area portals were kept locked and alarmed, and personnel in the protected area were properly badged. The inspectors identified no deficiencies in this area.

7.2 Radiological Control Activities

During plant tours, the inspectors checked high radiation area doors required to be locked and found them to be appropriately locked. Radiological postings were also checked and verified to be in accordance with licensee procedures.

7.3 Emergency Preparedness

On September 13, 1995, the licensee conducted the annual emergency preparedness exercise to verify the effectiveness of the Radiological Emergency Response Plan and implementing procedures. Details of the exercise, including the results of critiques held, are discussed in NRC Inspection Report 50-416/95-13.

The inspector participated in and observed the exercise from the technical support center (TSC). The inspector noted that the TSC coordinator was burdened with many duties, which included functions as both an emergency repair director and operations coordinator. The amount of information

processed by this individual tended to be overwhelming during certain times of the exercise. In addition, the inspector noted little tracking or prioritization of the technical issues that were raised during the exercise. The inspector also noted timely status briefings by the emergency director in the TSC. These comments were also identified by licensee personnel and discussed during the critique held after the exercise.

Although the NRC considered the exercise to be successful with no exercise weaknesses, the licensee's self-critique identified areas in need of improvement, which included protective action recommendations and offsite dose projections. The licensee implemented an action plan to address the deficiencies observed and started an aggressive schedule to conduct table top drills (four per week) before two remedial drills were to be conducted later this year.

8 FOLLOWUP - OPERATIONS (92901)

(Closed) Violation 416/9511-01: Failure to Lock Open Valves 1C41-F002B and 1F11-F021

The inspector verified completion of the licensee's corrective actions stated in the licensee's response letter, dated August 18, 1995. Locking devices were installed on the subject valves. Licensee personnel conducted a check of all accessible safety-related locked valves and verified proper locking devices were installed. A night order was issued and preshift briefings discussed the proper use of the locking devices. Training will be provided to license and nonlicensed operators during subsequent requalification training.

ENCLOSURE

1 PERSONS CONTACTED

Licensee Personnel

*D. Bost, Director, Nuclear Plant Engineering
*C. Bottemiller, Superintendent, Plant Licensing
*D. Cupstid, Manager, Performance and System Engineering (Acting)
W. Deck, Security Superintendent
M. Dietrich, Manager, Training
*J. Dimmette, Manager, Operations
C. Dugger, Manager, Outage Maintenance and Work Control
*C. Hayes, Director, Quality Assurance
C. Hutchinson, Vice President, Nuclear Operations
*A. Khanifar, Manager, Materials, Purchasing and Contracts
M. McDowell, Operations Superintendent
*M. Meisner, Director, Nuclear Safety and Regulatory Affairs
R. Moomaw, Manager, Plant Maintenance
A. Morgan, Manager, Emergency Preparedness
*D. Pace, General Manager, Plant Operations
S. Saunders, System Engineering Superintendent
*T. Tankersley, Radiation Control Superintendent

The inspectors contacted other licensee personnel during this inspection.

*Attended exit interview

2 EXIT MEETING

The inspectors conducted an exit meeting on October 20, 1995. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee did not express a position on the inspection findings documented in this inspection report. The licensee did not identify as proprietary any information provided to, or reviewed by, the inspectors.